

What is claimed is:

1. Diamond semiconductor having an exciton light-emission intensity characteristic that varies nonlinearly.
- 5 2. The diamond semiconductor according to claim 1, wherein the exciton light-emission is due to electron beam injection.
3. The diamond semiconductor according to claim 1, wherein the exciton light-emission has an optical wavelength of not more than 300nm.
- 10 4. The diamond semiconductor according to claim 1, wherein the exciton light-emission intensity increases rapidly in response to an electron beam above a threshold value.
- 5 5. The diamond semiconductor according to claim 1, wherein said diamond semiconductor is of high quality sufficient to emit ultraviolet light at room temperature in response to energy injection.
- 15 6. The diamond semiconductor according to claim 1, wherein said diamond semiconductor is an epitaxial diamond thin film obtained by diamond synthesis by means of a microwave plasma CVD method.
- 20 7. A diamond semiconductor light-emitting device comprising:
 - an *n*-type diamond semiconductor layer,
 - a *p*-type diamond semiconductor layer formed while maintaining a predetermined interval between it and said *n*-type diamond semiconductor layer, and
 - a high-quality undoped diamond semiconductor layer sandwiched between said *n*-type diamond semiconductor layer and said *p*-type diamond semiconductor layer,
wherein an exciton light emission that varies nonlinearly according to a current value is output from said undoped diamond semiconductor layer when current is injected to respective electrodes formed on said *n*-type and *p*-type diamond semiconductor layers.
- 25 8. A diamond semiconductor light-emitting device comprising:
 - a high-quality *n*-type diamond semiconductor layer,
 - a high-quality *p*-type diamond semiconductor layer formed in contact with said *n*-type diamond semiconductor layer, and
 - 30 an activation region layer formed in an interface between said *n*-type diamond semiconductor layer and said *p*-type diamond semiconductor layer,
wherein an exciton light emission that varies nonlinearly according to a current value

is output from the activation region layer when current is injected to respective electrodes formed on said *n*-type and *p*-type diamond semiconductor layers.

9. The diamond semiconductor light-emitting device according to claim 7, wherein said *n*-type and *p*-type diamond semiconductor layers are each formed by doping with an impurity under a gas phase during gas phase synthesis using a CVD method.

10. The diamond semiconductor light-emitting device according to claim 8, wherein said *n*-type and *p*-type diamond semiconductor layers are each formed with a high-quality undoped diamond semiconductor layer and by ion injection of an impurity in said undoped diamond semiconductor layer.

